

CLAIMS

- 1 1. A method of fabricating a membrane electrode assembly for use in a fuel cell, including the steps of:
 - 2 (A) providing a mold that includes a first and second mold plate
 - 3 adapted to impart a desired shape;
 - 4 (B) providing a lead frame, including at least a first lead frame component that is adapted to be received into said mold;
 - 5 (C) assembling a protonically conductive membrane with catalyst
 - 6 coatings on each of its major surfaces onto said first lead frame
 - 7 component;
 - 8 (D) placing said lead frame containing said membrane into the mold;
 - 9 (E) compressing said second mold plate onto said first mold plate;
 - 10 (F) introducing a moldable material in communication with said mold
 - 11 plates;; and
 - 12 (G) allowing the moldable material to cure in said mold to solidify and
 - 13 form a frame around said membrane to produce a membrane electrode assembly for use in a fuel cell.
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- 1 2. The method as defined in claim 1 including the further step of integrating a current collector into said first lead frame component onto which said membrane is placed.
- 1 3. The method as defined in claim 2 including the further steps of:
 - 2 (A) providing a second lead frame component that includes a second current collector; and
 - 3 (B) sandwiching said catalyzed membrane between the first and second current collectors;
 - 4 (C) introducing the lead frame components into said mold;
 - 5 (D) compressing the first and second mold plates together;
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- 8 (E) introducing a moldable material into said mold;
9 (F) allowing the moldable material to cure to form the shape of the mold
10 plates thereby forming a sealed fuel cell.

1 4. The method as defined in claim 1 wherein the step of introducing the moldable
2 material includes injection molding a moldable material into said mold.

1 5. The method as defined in claim 1 wherein the step of introducing the moldable
2 material includes placing said moldable material onto said mold plates and casting a
3 frame around the membrane electrode assembly.

1 6. A method of fabricating a fuel cell array, including the steps of:
2 (A) providing a mold that includes a first and second mold plate of a
3 desired shape;
4 (B) providing a sheet of protonically conductive membrane material
5 that has been coated on each of its major surfaces with a catalyst material to form
6 a sheet of catalyzed membrane;
7 (C) providing a lead frame structure that includes a plurality of indi-
8 vidual lead frame components that define separate fuel cells;
9 (D) assembling said sheet of catalyzed membrane into said lead frame
10 structure;
11 (E) placing said lead frame structure containing said membrane sheet
12 into the mold;
13 (F) compressing said second mold plate onto said first mold plate ;
14 (G) introducing a moldable material in communication with said mold
15 plates; and
16 (H) allowing the plastic to cure in said mold to solidify and form a
17 frame around said individual fuel cells to produce a fuel cell array.

1 7. A method of establishing a seal around a fuel cell, comprising the steps of:
2 (A) providing a lead frame assembly including:

- 3 (i) providing first and second current collectors adapted to serve as
4 lead frame components in an associated mold device;
5 (ii) assembling fuel cell components including:
6 (a) a catalyzed protonically conductive, electronically
7 non-conductive membrane; and
8 (b) first and second diffusion layers disposed on oppo-
9 site sides of said membrane;
10 (iii) arranging said fuel cell components between said first and
11 second current collectors;
12 (B) inserting the resulting lead frame assembly into a molding device;
13 (C) introducing a moldable material into said molding device; and
14 (D) allowing said moldable material to cure to seal the edges of the
15 lead frame assembly against leaks to thereby seal the fuel cell.

1 8. The method as defined in claim 7 comprising the further step of spot welding the
2 first and second current collectors that serve as lead frame components together to main-
3 tain the components in place.

1 9. The method as defined in claim 7 including the further step of trimming excess
2 lead frame component portions away from said fuel cell to result in a finished fuel cell.

1 10. The method as defined in claim 7 including the further step of providing said
2 mold device with a mold cavity which, when said moldable material is introduced into
3 said mold cavity and cured, creates a frame around said fuel cell.

1 11. A method of establishing a sealed diffusion layer for use in a fuel cell including
2 the steps of:

- 3 (A) providing a first current collector integrated into a lead frame component;
4 (B) applying a diffusion layer material to said first current collector on said
5 lead frame component;

- 6 (C) providing a second current collector integrated into a lead frame compo-
7 nent;
- 8 (D) applying a second diffusion layer material to said second current collector
9 on said lead frame component;
- 10 (E) placing a catalyzed protonically conductive, electronically non-conductive
11 membrane between said first lead frame component and said second lead frame compo-
12 nent to form an assembly;
- 13 (F) placing said assembly into a molding device;
- 14 (G) closing mold plates associated with said molding device and hot pressing
15 the assembly for a predetermined time period;
- 16 (H) introducing a moldable material into said mold cavity of said mold device;
17 and
- 18 (I) allowing said moldable material to cure to seal said lead frame compo-
19 nents integrating said first and second current collectors together to form a fuel cell.

1 12. The method as defined in claim 11 wherein step (H) includes an insert molding
2 technique.

1 13. The method as defined in claim 11 including the further step of spot welding said
2 first and second lead frame components together to maintain said components in position
3 prior to placing the assembly into the molding device.

1 14. A method of introducing compression into a fuel cell, comprising the steps of:

- 2 (A) providing a catalyst coated membrane;
- 3 (B) providing a first current collector integrated into a first lead frame compo-
4 nent suitable for being received into a molding device;
- 5 (C) providing a second current collector integrated into a second lead frame
6 component suitable for being received into a molding device;
- 7 (D) assembling said first and second current collectors on either side of said
8 membrane to result in an assembly;

- 9 (E) placing said assembly into said mold device that has been provided with
10 mold plates;
11 (F) closing said mold plates and maintaining said mold plates in a closed po-
12 sition to induce compression; and
13 (G) introducing a moldable material into the resulting mold cavity thereby cre-
14 ating a frame around the fuel cell that maintains compression within said fuel cell without
15 the need for mechanical fasteners.

- 1 15. A fuel cell manufactured by the steps of:
2 (A) providing a lead frame assembly including:
3 (i) providing first and second current collectors adapted to serve as lead
4 frame components in an associated mold device;
5 (ii) assembling fuel cell components including:
6 (a) a catalyzed protonically conductive, electronically non-
7 conductive membrane; and
8 (b) first and second diffusion layers disposed on opposite sides
9 of said membrane;
10 (iii) arranging said fuel cell components between said first and second cur-
11 rent collectors;
12 (B) inserting said lead frame assembly into an insert molding device;
13 (C) introducing a moldable material into said insert molding device; and
14 (D) allowing said moldable material to cure to seal the edges of the lead frame
15 assembly against leaks to thereby form a sealed fuel cell.

- 1 16. A component for use in a direct oxidation fuel cell comprising:
2 (A) a conductive material suitable for use as a current collector;
3 (B) a second material applied to said conductive material, which second mate-
4 rial acts as a diffusion layer in a fuel cell; and
5 (C) a lead frame structure disposed around said current collector material for
6 handling said component during a molding process.

1 17. The component as defined in claim 16 wherein a plurality of apertures are dis-
2 posed within said current collector for plastic flow through during an insert molding pro-
3 cess.

1 18. A direct oxidation fuel cell comprising:

2 (A) a catalyzed membrane electrolyte;

3 (B) an anode current collector disposed generally parallel to an anode aspect
4 of said catalyzed membrane electrolyte, said anode current collector including an anode
5 diffusion layer material that has been hot pressed to seal said diffusion layer material onto
6 said current collector; and

7 (C) a cathode current collector disposed generally parallel to a cathode aspect
8 of said membrane electrolyte, a cathode diffusion layer material having
9 been hot pressed onto said cathode current collector to seal it against leak-
10 ages; and

11 (D) disposing said catalyzed membrane between said anode current collector
12 and said cathode current collector, a load connected across said anode cur-
13 rent collector and said cathode current collector to utilize the electricity
14 produced in reactions generated when a fuel substance and oxygen are in-
15 troduced.

1 19. The direct oxidation fuel cell as defined in claim 18 wherein said anode current
2 collector includes pores sized in such a manner that the anode current collector functions
3 as a diffusion layer.

1 20. The direct oxidation fuel cell as defined in claim 18 wherein said cathode current
2 collector includes pores sized in such a manner that the cathode current collector func-
3 tions as a diffusion layer.

1 21. The fuel cell as defined in claim 18 wherein said anode current collector includes
2 channels therein such that said anode current collector also functions as a flow field plate.

- 1 22. The fuel cell as defined in claim 18 wherein said cathode current collector in-
2 cludes channels such that said cathode current collector functions as a flow field plate.